

## The identity of *Pseudomystus moeschii* (Boulenger, 1890), with the description of two new species of bagrid catfishes from Southeast Asia (Teleostei: Bagridae)

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### Abstract

The identity of the poorly known bagrid catfish *Pseudomystus moeschii* (Boulenger, 1890) is clarified and the species redescribed. Two new species of closely related bagrid catfishes are also described: *Pseudomystus carnosus* from the Way Seputih River drainage in the province of Lampung in the southern tip of Sumatra, and *P. fumosus* from the Pahang River drainage in eastern Peninsular Malaysia. *Pseudomystus carnosus*, *P. fumosus* and *P. moeschii* can be distinguished from congeners in having an enlarged posterior process of the post-temporal, presence of long hair-like epithelial projections on the skin and long tubular extensions of the sensory pores. *Pseudomystus carnosus* differs from the other two species in having a pointed (vs. rounded) tip of the nuchal shield, while *P. fumosus* differs from the other two species in having very well developed procurrent caudal rays which are sinuously curved along the anterior edges (vs. less developed procurrent caudal rays that slope evenly along the edges). A lectotype is designated for *P. moeschii*.

**Key words:** Sumatra, Peninsular Malaysia, Siluriformes, Pahang River, Way Seputih River

### Introduction

*Pseudomystus* species are small- to mid-sized bagrid catfishes that inhabit swamps, streams and rivers throughout Southeast Asia. There are currently 14 valid species of *Pseudomystus* (Kottelat et al., 1993; Kottelat, 2000; Ng & Rachmatika, 2000); many of them have a color pattern of contrasting vertical bars or blotches, which makes them attractive fishes for the aquarium trade (where they are known as bumblebee catfishes).

Members of the genus were traditionally included in *Leiocassis*, but Mo (1991) found the following synapomorphies that diagnosed them as distinct from *Leiocassis* s. str.: the loss or reduction (to a small hole enclosed entirely within the supraoccipital) of the posterior fontanelle, cranial elements largely exposed on the roof, the sensory canal in the pterotic excluded from the extrascapular and hypertrophied nuchal plates.

As part of a larger revisionary study of the genus by the authors, material from Sumatra and the Malay Peninsula identified as *Pseudomystus moeschii* (Boulenger, 1890) were examined and it was found that this material represented two distinct species in addition to *P. moeschii*. The redescription of *P. moeschii* (with the designation of a lectotype) and the descriptions of these two species as *P. carnosus* sp. nov. and *P. fumosus* sp. nov. form the basis of this study.

### Material and Methods

Measurements were made point to point with dial callipers and data recorded to tenths of a millimeter. Counts and measurements were made on the left side of specimens whenever possible. Subunits of the head are presented as proportions of head length (HL). Head length and measurements of body parts are given as proportions of standard length (SL). Measurements follow those of Ng & Dodson (1999). Asterisks after meristic counts indicate values for holotype.

Material examined in this study is deposited in the Academy of Natural Sciences, Philadelphia (ANSP), Zoological Museum, University of Malaya, Kuala Lumpur (BIRCUM), the Natural History Museum, London (BMNH), the California Academy of Sciences, San Francisco (CAS), the Field Museum of Natural History, Chicago (FMNH), the Museum Zoologicum Bogoriense, Cibinong, Indonesia (MZB), the Nationaal Natuurhistorisch Museum, Leiden (RMNH), the National Museum of Natural History, Smithsonian Institution, Washington DC (USNM), the Zoölogisch Museum Amsterdam, Amsterdam (ZMA) and the Zoological Reference Collection, Singapore (ZRC).

### *Pseudomystus moeschii* (Boulenger, 1890)

Fig. 1

*Leiocassis moeschii* Boulenger, 1890: 39 (type locality: Deli River, Sumatra); Volz, 1907: 167.

*Leiocassis moeschi* — Weber & de Beaufort, 1913: 364.

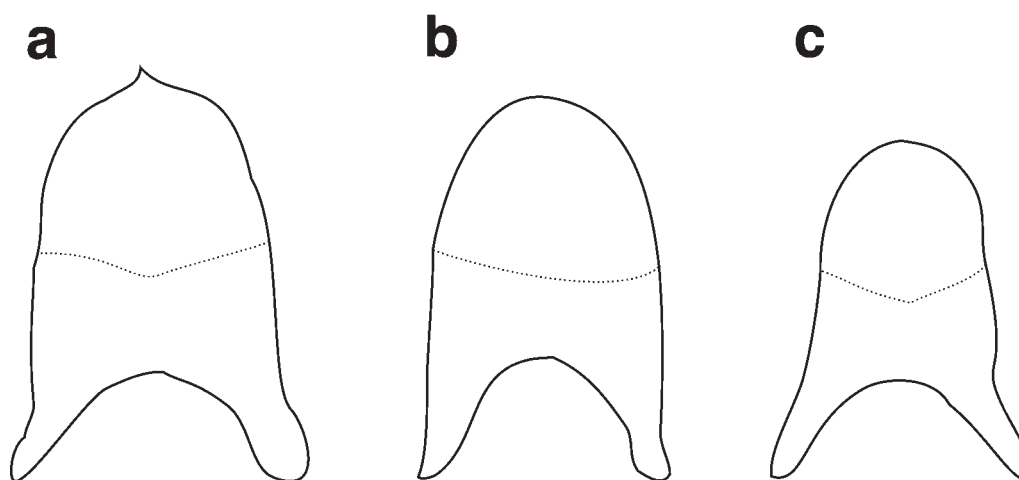
*Leiocassis moeschii* — Kottelat et al., 1993: 64, pl. 31.

**Material examined.** BMNH 1889.11.12.66, lectotype, female, 71.0 mm SL; Sumatra: Deli. UMMZ 243700 (1), male, 66.9 mm SL; Sumatra: Sumatera Selatan, Sungai Merdaka in the vicinity of Sukajaya, 1°55'54.1"N 103°44'23.7"E.



**FIGURE 1.** *Pseudomystus moeschii*, UMMZ 243700, 66.9 mm SL; Sumatra: Sumatera Selatan, Sungai Merdak.

**Diagnosis.** *Pseudomystus moeschii* can be distinguished from congeners, except for *P. carnosus* and *P. fumosus*, in having an enlarged and prominent process of the post-temporal (the supraclavicular process of previous authors), which is almost as long as (vs. less than one third the length of) the postcleithral process, the presence (vs. absence) of long hair-like epithelial projections on the skin and long tubular extensions of the sensory pores. *Pseudomystus moeschii* can be distinguished from *P. carnosus* and *P. fumosus* in having a more slender body (13.0–14.5% SL vs. 14.9–16.7) and possessing (vs. lacking) lighter colored patches on the body. It further differs from *P. carnosus* in having a rounded (vs. pointed) tip of the nuchal shield (Fig. 2), and from *P. fumosus* in having less developed procurrent caudal rays that are evenly sloping along the anterior edges (vs. well developed procurrent caudal rays that curve sinuously along the edges; Fig. 3).



**FIGURE 2.** Dorsal views of nuchal plates of: a. *Pseudomystus carnosus*, RMNH 15860, paratype, 82.8 mm SL; b. *P. fumosus*, ZRC 3229, holotype, 73.6 mm SL; c. *P. moeschii*, UMMZ 243700, 66.9 mm SL. Scale bar represents 5 mm.



**FIGURE 3.** Caudal fins and procurent caudal rays of: a. *Pseudomystus fumosus*, paratype, BIRCUM 4428, 66.0 mm SL; b. *P. carnosus* and *P. moeschii* (*P. moeschii*, UMMZ 243700, 66.9 mm SL illustrated). Scale bar represents 10 mm.

**Description.** Biometric data as in Table 1. Head depressed; dorsal profile slightly convex and ventral profile almost straight; snout broadly rounded when viewed dorsally. Bony elements of dorsal surface of head covered with thin skin; bones visible, especially on posterior half of neurocranium, and ornamented with numerous fine, radial grooves. Midline of cranium with fontanelle extending from behind snout to just beyond level of posterior orbital margin. Supraoccipital process moderately broad, with gently converging sides and blunt tip; extending to nuchal plate. Supratemporal with long posterior process, almost as long as cleithral process. Eye ovoid, horizontal axis longest, with free margin; located entirely in dorsal half of head. Gill openings wide, extending from post-temporal to beyond isthmus. Gill membranes free from isthmus, with 7 (2) branchiostegal rays. First branchial arch with 3+9 (1) gill rakers.

Mouth subterminal. Oral teeth small and viliform, in irregular rows on all tooth-bearing surfaces. Premaxillary tooth band rounded, of equal width throughout. Dentary tooth band much narrower than premaxillary tooth band at symphysis, tapering laterally. Vomerine tooth band unpaired, continuous across midline; smoothly arched along anterior

margin, tapering laterally to point extending posteriorly past level of premaxillary band; band width narrower than premaxillary band at midline, widening laterally and then tapering to a sharp point postero-laterally.

**TABLE 1.** Biometric data for *Pseudomystus moeschii* (n=2).

	Lectotype BMNH 1889.11.12.66	UMMZ 243700
Standard length (mm)	71.0	66.9
<b>% SL</b>		
Predorsal length	37.9	38.7
Preanal length	65.9	66.1
Prepelvic length	50.3	50.0
Prepectoral length	23.2	26.1
Length of dorsal-fin base	10.8	11.5
Dorsal-spine length	16.5	16.1
Anal-fin length	13.9	16.9
Pelvic-fin length	13.0	15.2
Pectoral-fin length	damaged	20.9
Pectoral-spine length	21.4	16.9
Caudal-fin length	25.9	25.6
Length of adipose-fin base	27.7	25.1
Adipose maximum height	4.9	5.4
Dorsal-adipose distance	23.1	12.0
Post-adipose distance	13.0	13.9
Caudal peduncle length	17.9	18.8
Caudal peduncle depth	6.3	7.5
Body depth at anus	14.5	13.0
Head length	26.5	30.5
Head width	15.6	17.2
Head depth	16.8	16.4
<b>%HL</b>		
Snout length	31.9	29.4
Interorbital distance	25.5	25.0
Eye diameter	12.8	14.7
Nasal barbel length	damaged	36.3
Maxillary barbel length	damaged	75.0
Inner mandibular barbel length	damaged	32.8
Outer mandibular barbel length	damaged	60.3

Barbels in four pairs. Maxillary barbel slender, extending for three quarters of head length. Nasal barbel slender, extending to one third of distance between posterior orbital margin and dorsal-most extent of gill opening. Inner mandibular-barbel origin close to midline, thicker and longer than nasal barbel and extending for half of head length. Outer mandibular barbel originates postero-lateral of inner mandibular barbel, extending for three quarters of head length.

Body slightly compressed, becoming more so toward caudal peduncle. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin and sloping gently ventrally from origin of dorsal fin to end of caudal peduncle. Ventral profile slightly convex to anal-fin base, then sloping slightly dorsally to end of caudal peduncle. Skin smooth, with long hair-like epithelial projections; projections especially prominent on head and dorsal third of body. Lateral line complete and mid-lateral in position, sensory pores of lateral line with long, tubular extensions. Vertebrae  $17+24=41$  (1).

Dorsal fin with spinelet, spine, and 7 (2) rays. Origin of dorsal fin anterior to mid-body, about two-fifths of body. Dorsal fin margin convex, usually with anterior branch of fin rays longer than other branches. Dorsal fin spine short, straight and slender, posterior edge without serrations. Nuchal shield moderately broad, with rounded tip anteriorly.

Pectoral fin with stout spine, sharply pointed at tip, and 8 (2) rays. Anterior spine margin smooth; posterior spine margin with 13 large serrations along entire length (serrations fewer in smaller specimens). Pectoral fin margin straight anteriorly, convex posteriorly. Cleithral process moderately broad, with slightly convex dorsal margin and extending for two thirds of pectoral-spine length.

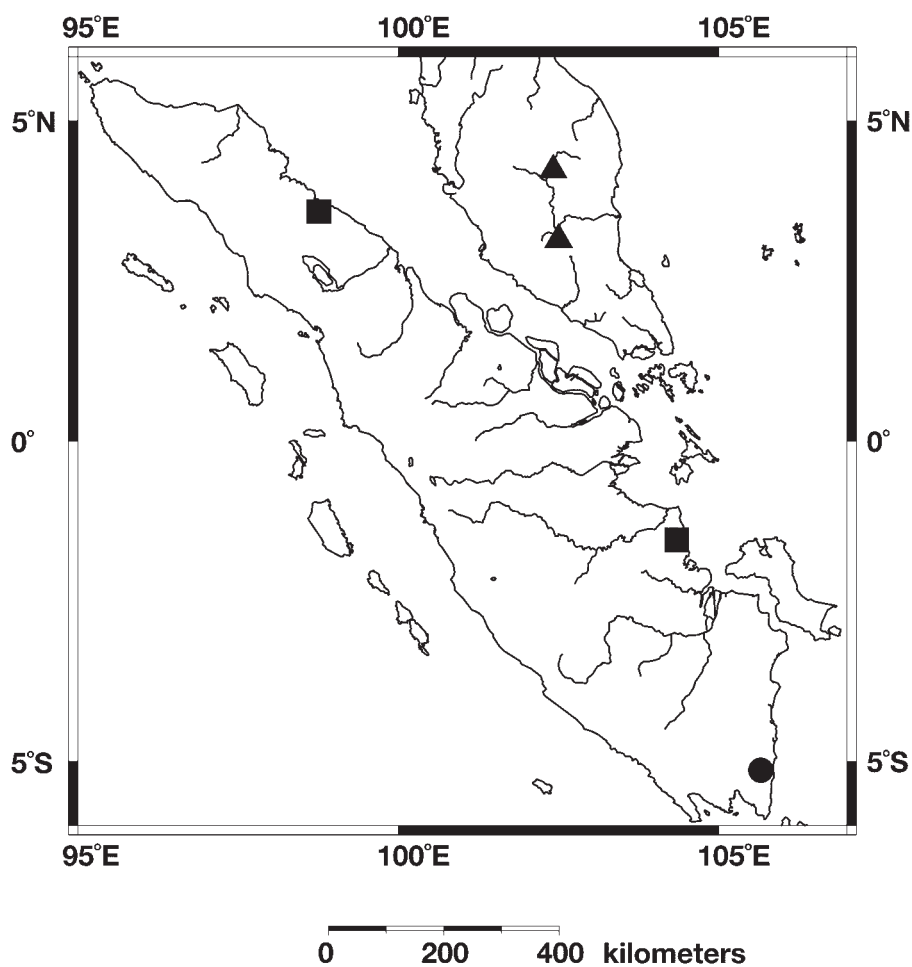
Pelvic fin origin at vertical through posterior end of dorsal-fin base, with i,5 (2) rays and slightly convex margin; tip of adpressed fin not reaching anal fin origin. Anus and urogenital openings located at vertical through middle of adpressed pelvic fin. Males with a conical genital papilla reaching to base of first anal-fin ray.

Adipose fin with convex margin for entire length, with deeply-incised posterior portion and origin in contact with base of last dorsal-fin ray; fin-base long, spanning two-thirds of post-dorsal distance. Anal fin base just posterior to vertical through origin of adipose fin, with v,10 (2) rays and curved posterior margin.

Caudal peduncle moderately deep. Caudal fin deeply forked, with i,7,8,i (2) principal rays; upper lobe slender and lanceolate, lower lobe pointed. Procurrent rays extend anterior to fin base, with evenly-sloping anterior margins.

**Coloration.** In 70% ethanol: dorsal and lateral surfaces of head and body dark purplish brown, fading to brown on ventral surfaces of head and body. Lateral line with thin, pale stripe. Lateral surfaces of body with pairs of irregular brown patches located dorsal and ventral to lateral line: one at region between dorsal and adipose fins, another at middle of adipose fin base. Fifth pale spot at base of first few anal-fin rays. Adipose fin dark purplish gray. Dorsal, caudal and all paired fins with purplish gray fin rays and hyaline distal margin, inter-radial membranes of all fins with scattered melanophores. Barbels purplish gray dorsally, light gray ventrally.

**Distribution.** Known from eastern Sumatra (in the Deli and the Banjuasin River drainages; Fig. 4).



**FIGURE 4.** Map showing distribution of *Pseudomystus carnosus* (●), *P. fumosus* (▲) and *P. moeschii* (■).

***Pseudomystus carnosus* sp. nov.**

Fig. 5

*Leiocassis moeschii* (non Boulenger) - Jayaram, 1968: 362.

**Type material.** Holotype: RMNH 15859, male, 78.1 mm SL; Sumatra: Sukadana; van Hasselt, June 1883.

Paratypes: RMNH 35223, female, 65.7 mm SL; data as for holotype. RMNH 15860, 2 males, 62.4–82.8 mm SL; Sumatra Lampung; van Hasselt, December 1881.



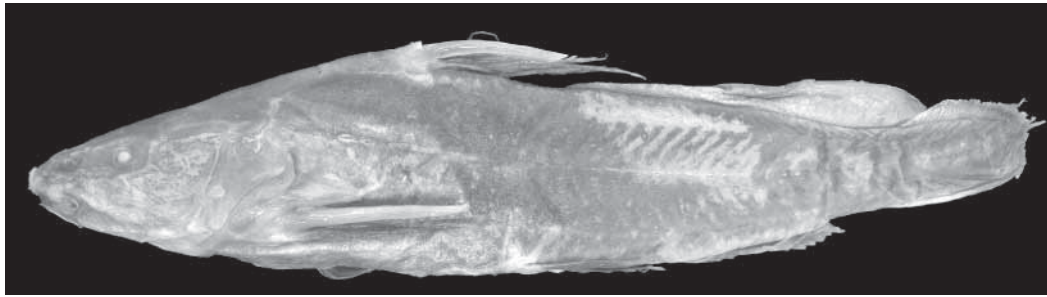


FIGURE 5. *Pseudomystus carnosus*, RMNH 15859, holotype, 78.1 mm SL; Sumatra: Sukadana.

**Diagnosis.** *Pseudomystus carnosus* can be distinguished from congeners, except for *P. fumosus* and *P. moeschii*, in having an enlarged and prominent process of the post-temporal (the “supraclavicular process” of previous authors), which is almost as long as (vs. less than one third the length of) the post-cleithral process, the presence (vs. absence) of long hair-like epithelial projections on the skin and long tubular extensions of the sensory pores. *Pseudomystus carnosus* can be distinguished from *P. fumosus* and *P. moeschii* in having a pointed (vs. rounded) tip of the nuchal shield (Fig. 2). It further differs from *P. fumosus* in having less developed procurent caudal rays that are evenly sloping along the anterior edges (vs. well developed procurent caudal rays that curve sinuously along the edges; Fig. 3) and from *P. moeschii* in having a deeper body (13.0–16.7% SL vs. 13.0–14.5) and lacking (vs. possessing) lighter colored patches on the body.

**Description.** Biometric data as in Table 2. Head depressed; dorsal profile slightly convex and ventral profile almost straight; snout broadly rounded when viewed dorsally. Bony elements of dorsal surface of head covered with thin skin; bones visible, especially on posterior half of neurocranium, and ornamented with numerous fine, radial grooves. Midline of cranium with fontanelle extending from behind snout to just beyond level of posterior orbital margin. Supraoccipital process moderately broad, with gently converging sides and blunt tip; extending to nuchal plate. Supratemporal with long posterior process, almost as long as cleithral process. Eye ovoid, horizontal axis longest, with free margin; located entirely in dorsal half of head. Gill openings wide, extending from post-temporal to beyond isthmus. Gill membranes free from isthmus, with 7\* (3) or 8 (1) branchiostegal rays. First branchial arch with 3+6\* (3) or 3+9 (1) gill rakers.

Mouth subterminal. Oral teeth small and viliform, in irregular rows on all tooth-bearing surfaces. Premaxillary tooth band rounded, of equal width throughout. Dentary tooth band much narrower than premaxillary tooth band at symphysis, tapering laterally. Vomerine tooth band unpaired, continuous across midline; smoothly arched along anterior margin, tapering laterally to point extending posteriorly past level of premaxillary band; band width narrower than premaxillary band at midline, widening laterally and then tapering to a sharp point postero-laterally.



**TABLE 2.** Biometric data for *Pseudomystus carnosus* (n=4).

	Holotype	Range	Mean±SD
<b>%SL</b>			
Predorsal length	38.2	37.3–39.3	38.4±0.88
Preanal length	65.9	63.5–65.9	64.4±1.03
Prepelvic length	49.8	48.7–51.3	50.3±1.21
Prepectoral length	25.2	24.8–26.1	25.4±0.55
Length of dorsal-fin base	12.2	10.0–12.2	10.9±0.94
Dorsal-spine length	17.4	16.9–17.8	17.4±0.45
Anal-fin length	16.1	14.5–16.1	15.3±0.90
Pelvic-fin length	15.6	12.7–15.6	14.4±1.32
Pectoral-fin length	23	21.3–23.0	22.2±0.86
Pectoral-spine length	18.4	18.4–19.3	18.9±0.39
Caudal-fin length	damaged	20.2	—
Length of adipose-fin base	33.2	30.0–33.8	31.8±2.03
Adipose maximum height	5.8	4.8–5.9	5.4±0.58
Dorsal to adipose distance	5.4	5.4–10.7	8.3±2.21
Post-adipose distance	12.4	12.0–12.8	12.4±0.33
Caudal peduncle length	19.7	18.3–19.7	19.1±0.78
Caudal peduncle depth	7.5	5.9–7.5	6.6±0.68
Body depth at anus	15.6	14.9–16.0	15.4±0.50
Head length	26.1	26.1–27.4	27.0±0.61
Head width	17.4	16.8–17.4	17.0±0.26
Head depth	16	16.0–17.6	16.7±0.72
<b>%HL</b>			
Snout length	34.8	30.6–34.8	32.7±2.04
Interorbital distance	27.9	24.3–27.9	25.6±1.57
Eye diameter	9.3	9.3–13.3	11.3±1.84
Nasal barbel length	24.5	14.7–33.3	23.7±7.67
Maxillary barbel length	71.1	47.3–67.8	60.8±10.82
Inner mandibular barbel length	36.8	24.7–43.9	35.0±7.93
Outer mandibular barbel length	46.6	35.3–52.8	43.6±7.68

Barbels in four pairs. Maxillary barbel slender, extending for three quarters of head length. Nasal barbel slender, extending to one third of distance between posterior orbital margin and dorsalmost extent of gill opening. Inner mandibular-barbel origin close to midline, thicker and longer than nasal barbel and extending for half of head length. Outer

mandibular barbel originates postero-lateral of inner mandibular barbel, extending for three quarters of head length..

Body slightly compressed, becoming more so toward caudal peduncle. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin and sloping gently ventrally from origin of dorsal fin to end of caudal peduncle. Ventral profile slightly convex to anal-fin base, then sloping slightly dorsally to end of caudal peduncle. Skin smooth, with long hair-like epithelial projections; projections especially prominent on head and dorsal third of body. Lateral line complete and mid-lateral in position, sensory pores of lateral line with long, tubular extensions. Vertebrae  $17+25=42$  (4).

Dorsal fin with spinelet, spine, and 7 (4) rays. Origin of dorsal fin anterior to mid-body, about two-fifths of body. Dorsal fin margin convex, usually with anterior branch of fin rays longer than other branches. Dorsal fin spine short, straight and slender, posterior edge without serrations. Nuchal shield moderately broad, with rounded tip anteriorly.

Pectoral fin with stout spine, sharply pointed at tip, and 6 (4) rays. Anterior spine margin smooth; posterior spine margin with 13–16 large serrations along entire length (serrations fewer in smaller specimens). Pectoral fin margin straight anteriorly, convex posteriorly. Cleithral process moderately broad, with slightly convex dorsal margin and extending for two thirds of pectoral-spine length.

Pelvic fin origin at vertical through posterior end of dorsal-fin base, with i,5 (4) rays and slightly convex margin; tip of adpressed fin not reaching anal fin origin. Anus and urogenital openings located at vertical through middle of adpressed pelvic fin. Males with a conical genital papilla reaching to base of first anal-fin ray.

Adipose fin with convex margin for entire length, with deeply-incised posterior portion and origin in contact with base of last dorsal-fin ray; fin-base long, spanning two-thirds of postdorsal distance. Anal fin base just posterior to vertical through origin of adipose fin, with v,10 (4) rays and curved posterior margin.

Caudal peduncle moderately deep. Caudal fin deeply forked, with i,7,8,i (4) principal rays; upper lobe slender and lanceolate, lower lobe pointed. Procurrent rays extend anterior to fin base, with evenly-sloping anterior margins.

**Coloration.** In 70% ethanol: dorsal and lateral surfaces of head and body brown, fading to a grayish white on ventral surfaces of head and body. Adipose fin brown. Dorsal, caudal and all paired fins with dusky brown fin rays and hyaline distal margin, interradi al membranes of all fins with scattered melanophores. Barbels brown dorsally, grayish white ventrally.

**Distribution.** Known from the Way Seputih River drainage in Lampung province, southern Sumatra (Fig. 4).

**Etymology.** From the Latin *carnosus*, meaning fleshy, in reference to the robust body of this species when compared to *P. moeschii*. Used as an adjective.

*Pseudomystus fumosus* sp. nov.

Fig. 6

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**Type material.** Holotype: ZRC 3229, male, 73.6 mm SL; Malaysia: Pahang, Taman Negara, Kuala Tahan; J. R. Hendrickson, July–August 1954.

Paratype: BIRCUM 4428, 1 male, 66.0 mm SL; Malaysia: Pahang, Sungai Lompat, a tributary of Sungai Krau, 3°41'40"N 102°12'40"E; M. Zakaria-Ismail, 20 Jun 1994.



**FIGURE 6.** *Pseudomystus fumosus*, ZRC 3229, holotype, 73.6 mm SL; Malaysia: Pahang, Kuala Tahan.

**Diagnosis.** *Pseudomystus fumosus* can be distinguished from congeners, except for *P. carnosus* and *P. moeschii*, in having an enlarged and prominent process of the post-temporal (the “supraclavicular process” of previous authors), which is almost as long as (vs. less than one third the length of) the postcleithral process, the presence (vs. absence) of long hair-like epithelial projections on the skin and long tubular extensions of the sensory pores. *Pseudomystus fumosus* can be distinguished from both *P. carnosus* and *P. moeschii* in having very well developed procurent caudal rays that are sinuously curved along the anterior edges (vs. less developed procurent caudal rays that slope evenly along the edges; Fig. 3). It further differs from *P. carnosus* in having a rounded (vs. pointed) tip of the nuchal shield (Fig. 2) and from *P. moeschii* in having a deeper body (13.0–16.7% SL vs. 13.0–14.5) and lacking (vs. possessing) light colored patches on the body.

**Description.** Biometric data as in Table 3. Head depressed; dorsal profile slightly convex and ventral profile almost straight; snout broadly rounded when viewed dorsally. Bony elements of dorsal surface of head covered with thin skin; bones visible, especially on posterior half of neurocranium, and ornamented with numerous fine, radial grooves. Midline of cranium with fontanelle extending from behind snout to just beyond level of posterior orbital margin. Supraoccipital process moderately broad, with gently converging sides and blunt tip; extending to nuchal plate. Supratemporal with long posterior process,

almost as long as cleithral process. Eye ovoid, horizontal axis longest, with free margin; located entirely in dorsal half of head. Gill openings wide, extending from post-temporal to beyond isthmus. Gill membranes free from isthmus, with 8 (2) branchiostegal rays. First branchial arch with 3+9 (2) gill rakers.

**TABLE 3.** Biometric data for *Pseudomystus fumosus* (n=2).

	<b>Holotype ZRC 3229</b>	<b>Paratype BIRCUM 4428</b>
Standard length	73.6	66.0
<b>% SL</b>		
Predorsal length	38.3	38.5
Preanal length	63.3	63.6
Prepelvic length	50.5	50.2
Prepectoral length	28.0	22.3
Length of dorsal-fin base	10.6	10.9
Dorsal-spine length	14.3	16.2
Anal-fin length	17.4	17.4
Pelvic-fin length	13.6	14.2
Pectoral-fin length	19.7	23.6
Pectoral-spine length	16.2	20.2
Caudal-fin length	damaged	19.7
Length of adipose-fin base	30.4	25.5
Adipose maximum height	6.1	5.2
Dorsal-adipose distance	13.3	13.0
Post-adipose distance	12.1	12.4
Caudal peduncle length	18.9	18.6
Caudal peduncle depth	7.6	8.2
Body depth at anus	16.7	16.5
Head length	29.3	27.7
Head width	17.7	20.2
Head depth	17.9	17.4
<b>%HL</b>		
Snout length	28.2	34.4
Interorbital distance	26.9	26.8
Eye diameter	10.6	12.6
Nasal barbel length	26.9	30.1
Maxillary barbel length	48.6	54.1
Inner mandibular barbel length	28.7	31.7
Outer mandibular barbel length	49.5	48.1

Mouth subterminal. Oral teeth small and viliform, in irregular rows on all tooth-bearing surfaces. Premaxillary tooth band rounded, of equal width throughout. Dentary tooth band much narrower than premaxillary tooth band at symphysis, tapering laterally. Vomerine tooth band unpaired, continuous across midline; smoothly arched along anterior margin, tapering laterally to point extending posteriorly past level of premaxillary band; band width narrower than premaxillary band at midline, widening laterally and then tapering to a sharp point postero-laterally.

Barbels in four pairs. Maxillary barbel slender, extending for three quarters of head length. Nasal barbel slender, extending to one third of distance between posterior orbital margin and dorsalmost extent of gill opening. Inner mandibular-barbel origin close to midline, thicker and longer than nasal barbel and extending for half of head length. Outer mandibular barbel originates postero-lateral of inner mandibular barbel, extending for three quarters of head length.

Body slightly compressed, becoming more so toward caudal peduncle. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin and sloping gently ventrally from origin of dorsal fin to end of caudal peduncle. Ventral profile slightly convex to anal-fin base, then sloping slightly dorsally to end of caudal peduncle. Skin smooth, with long hair-like epithelial projections; projections especially prominent on head and dorsal third of body. Lateral line complete and mid-lateral in position, sensory pores of lateral line with long, tubular extensions. Vertebrae  $17+23=40$  (1)\* or  $18+24=42$  (1).

Dorsal fin with spinelet, spine, and 7 (2) rays. Origin of dorsal fin anterior to mid-body, about two-fifths of body. Dorsal fin margin convex, usually with anterior branch of fin rays longer than other branches. Dorsal fin spine short, straight and slender, posterior edge without serrations. Nuchal shield moderately broad, with rounded tip anteriorly.

Pectoral fin with stout spine, sharply pointed at tip, and 7 (1) or 9 (1) rays. Anterior spine margin smooth; posterior spine margin with 15 large serrations along entire length (serrations fewer in smaller specimens). Pectoral fin margin straight anteriorly, convex posteriorly. Cleithral process moderately broad, with slightly convex dorsal margin and extending for two thirds of pectoral-spine length.

Pelvic fin origin at vertical through posterior end of dorsal-fin base, with i,5 (2) rays and slightly convex margin; tip of adpressed fin not reaching anal fin origin. Anus and urogenital openings located at vertical through middle of adpressed pelvic fin. Males with a conical genital papilla reaching to base of first anal-fin ray.

Adipose fin with convex margin for entire length, with deeply-incised posterior portion and origin in contact with base of last dorsal-fin ray; fin-base long, spanning two-thirds of postdorsal distance. Anal fin base just posterior to vertical through origin of adipose fin, with iv,12 (1) or iv,13 (1) rays and curved posterior margin.

Caudal peduncle moderately deep. Caudal fin deeply forked, with i,7,8,i (2) principal rays; upper lobe slender and lanceolate, lower lobe pointed. Procurrent rays extend anterior to fin base, with sinuous anterior margins.

**Coloration.** In 70% ethanol: dorsal and lateral surfaces of head and body brown, fading to a grayish white on ventral surfaces of head and body. Adipose fin brown. Dorsal, caudal and all paired fins with dusky brown fin rays and hyaline distal margin, inter-radial membranes of all fins with scattered melanophores. Barbels brown dorsally, grayish white ventrally.

**Distribution.** Known from the upper Pahang River drainage in eastern Peninsular Malaysia (Fig. 4).

**Habitat.** The holotype of *Pseudomystus fumosus* was collected at Kuala Tahan from either the Sungai Tembeling or the Sungai Tahan. The Sungai Tembeling is a large channel over 50 m wide that has cream to reddish sediment-laden water over silt and sand substrates. The Sungai Tahan at Kuala Tahan is a smaller channel that is about 20 m wide with clear but tannin-stained water over rocks, pebble and sand substrate. The paratype was obtained from Kuala Lompat, a tributary of the Sungai Krau. It was caught in a 5-m wide forest stream under 60% canopy cover. The crystal-clear water was about 1 m deep and relatively fast-flowing over a substrate of pebbles and sand (M. Zakaria-Ismail, pers. comm. to second author).

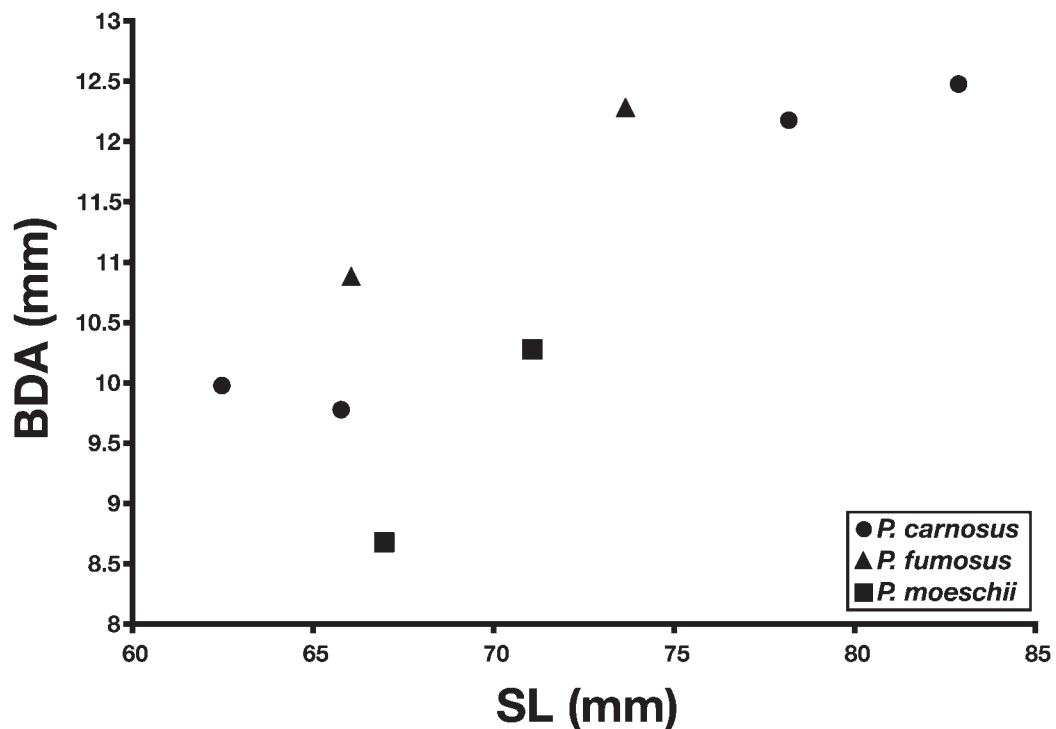
**Etymology.** From the Latin *fumosus*, meaning smoke, in reference to its uniform grayish-brown body. An adjective.

## Discussion

*Pseudomystus carnosus*, *P. fumosus* and *P. moeschii* are hypothesized to form a monophyletic group based on their possession of an enlarged and prominent process of the post-temporal that is almost as long as the postcleithral process, which is considered a synapomorphy. The three species also possess long hair-like epithelial projections on the skin and long tubular extensions of the sensory pores. These two characters are shared with a clade comprising *Bagrichthys*, *Bagroides* and *Leiocassis*, and have previously been considered synapomorphies for that clade (Mo, 1991). This raises the possibility that *Pseudomystus* as currently understood may not be monophyletic. However, in the light of limited material and evidence available to us, we are unable to investigate this problem in greater depth for now.

*Pseudomystus moeschii* was originally described from three syntypes (BMNH 1889.11.12.64–66; Boulenger, 1890: 39). Two of the syntypes (BMNH 1889.11.64–65) were found to belong to a different species, which was subsequently described as *Pseudomystus breviceps* by Regan (1913). Our examination of all three syntypes of *P. moeschii* indicate that *P. breviceps* is a distinct species. Given that the type series of *P. moeschii* consists of more than one species, it is necessary to designate a lectotype for *Pseudomystus moeschii* in order to stabilize the taxonomy of this species. Therefore, we hereby designate BMNH 1889.11.12.66 as the lectotype of *Liocassis moeschii* Boulenger, 1890.

The difference in the body depth between *P. carnosus* and *P. fumosus* combined and *P. moeschii* are not likely to be related to ontogeny, as a biplot of the body depth at anus against SL (Fig. 7) indicates. It can be argued that the state of the preservation and age of the specimens of *P. carnosus* available for study preclude any meaningful use of this biometric character as a diagnostic one. However, we note that *P. carnosus* actually has a deeper body than either *P. fumosus* or *P. moeschii*, while the shrinkage typically associated with specimens that have been preserved for a long time would dictate that the older specimens (here *P. carnosus*) have a measurably slenderer body. Therefore, although the numbers of specimens examined are too small for any meaningful statistical analysis, we believe that these differences will hold up once more material is made available and studied. The three species can also be clearly distinguished by morphological differences other than biometrics (see diagnoses), which lead us to conclude their distinctiveness.



**FIGURE 7.** Scatterplot of body depth at anus (BDA) against standard length for *P. carnosus*, *P. fumosus* and *P. moeschii*.



**Comparative material**

*Pseudomystus bomboides*: ZRC 45426, holotype, 41.2 mm SL; Laos: Vientiane Province, Mekong basin; confluence of Nam Leuk and Nam Ngong, 18°22'4"N 103°5'27"E.

*P. breviceps*: BMNH 1889.11.12.64–65, 2 syntypes, 66.8–80.6 mm SL; Sumatra: Deli (Medan).

*P. flavipinnis*: MZB 6593, holotype, 47.0 mm SL; Borneo: Kalimantan Barat, Sungai Embaloh at Benua Marinus.

*P. fuscus*: RMNH 7555, holotype, 39.6 mm SL; Borneo: upper Mahakam. ZRC 46144 (18) 34.0–42.6 mm SL; Borneo: Sarawak, Sungai Sebiris, 13.8 km after Kg. Pueh turnoff towards Lundu on Sematan-Lundu road, 1°41'32.0"N 109°47'0.8"E.

*P. inornatus*: BMNH 1893.3.6.179, holotype, 119.2 mm SL; Borneo: Sarawak, Senah.

*P. leiacanthus*: ZMA 112.671, syntype, 43.2 mm SL; Sumatra: Indragiri (Kwantan) River at Taluk. ZMA 112.672, syntype, 59.8 mm SL; Sumatra: Indragiri (Kwantan) River at Rengat. ZRC 46138 (11), 28.7–38.6 mm SL; Riau Archipelago: Pulau Bintan, 49 km to Tg. Pinang, 1°6'25.5"N 104°28'32.4"E.

*P. mahakamensis*: RMNH 7838, 2 syntypes, 83.8–84.6 mm SL; Borneo: Mahakam River at Tepoe. CMK 7785 (1), 93.9 mm SL; Borneo: Kalimantan Timur, Mahakam River among boulders upstream of Melak, 0°12'S 115°47'E.

*P. myersi*: CAS 49375, 3 paratypes, 42.9–86.1 mm SL; USNM 230280, 3 paratypes, 39.0–73.6 mm SL; Borneo: Kalimantan Barat, small stream into Kapuas River, northeast of Gg. Setunggul, 53 km northwest of Sintang, 10 km northwest of Silat (0°24'N 111°51'E).

*P. robustus*: FMNH 68001, holotype, 215.5 mm SL; Borneo: Sabah, Kinabatangan River at Deramakot. FMNH 68002; 1 paratype, 203.4 mm SL; FMNH 68040, 1 paratype, 253.3 mm SL; Borneo: Sabah: Kinabatangan River at Deramakot. ZRC 45497 (2), 108.3–122.0 mm SL; Borneo: Sabah, Kinabatangan River at Pekan Bukit Garam (Pangkalan).

*P. rugosus*: BMNH 1893.3.6.172, holotype, 103.1 mm SL; Borneo: Sarawak, Poeh.

*P. siamensis*: BMNH 1897.10.8.126, holotype, 76.5 mm SL; Thailand: Chao Phraya basin, Bangpakong River. ANSP 59284 (1), 42.4 mm SL [holotype of *Leiocassis bicolor*]; ANSP 59285–59289 (5), 37.6–45.6 mm SL [paratypes of *Leiocassis bicolor*]; Thailand: Chiang Mai. ANSP 60178 (1), 85.6 mm SL [holotype of *Leiocassis albicollaris*]; Thai-

land: Bangkok. CAS 94782, 64: 30.4–107.0; Cambodia: Ratanakiri Province, O Champha, 4–8 km upstream from its mouth into Tonle San near Te Veng.

*P. stenomus*: RMNH 2986, holotype, 69.1 mm SL; Java. ZRC 42587, 5: 67.3–79.8 mm SL; Java: Bogor, purchased from roadside vendor at Pasar Anya.

*P. vaillanti*: RMNH 7840, holotype, 105.5 mm SL; Borneo: Nanga Raoen, mouth of Raoen River. ZRC 46133 (16), 30.1–106.5 mm SL; Borneo: Kalimantan Barat, Pontianak.

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